10/559678
IAP9 Rec'd PCT/PTO 06 DEC 2005

TITLE OF THE INVENTION

Fuel Tank

BACKGROUND OF THE INVENTION

The subject matter of the invention is a fuel tank with a ventilation system. Such fuel tanks are intended for use in motor vehicles.

It is known to provide fuel tanks in motor vehicles with a ventilation system. The ventilation system undertakes both the supply and ventilation of air. Whilst the supply of air is necessary in order to avoid a vacuum in the fuel tank as the fuel level decreases, the ventilation of air serves to avoid excess pressure in the fuel tank. Excess pressure can be brought about when filling the fuel tank with fuel on account of the increasing fuel level. In this case, the excess pressure leads to a hindrance in the filling of the fuel tank, with the result that the filling of the fuel tank takes a very long time. Excess pressure is also brought about by high temperatures, since the expansion of the fuel reduces the free volume in the fuel tank. In addition, the fuel vaporizes at high temperatures, in particular when hot fuel which has not been used in the engine is returned to the fuel tank. As a result of the excess pressure, the structure of the fuel tank is subject to intense loading, which in the worst case can lead to damage to the fuel tank. In this respect, the ventilation system serves for safe operation of the fuel tank.

Such ventilation systems are arranged in the upper region of the fuel tank and have an opening in this region, via which air is led into the fuel tank or gases are led out of the fuel tank. If the vehicle is in an inclined position for an extended period of time, for example whilst parked, the ventilation opening lies below the fuel level if the fuel tank is nearly full. As a result, the ventilation opening is closed and the fuel tank cannot be ventilated.

It is also known to provide a ventilation system having a plurality of openings for ventilating the fuel tank, the openings being arranged in different regions of the fuel tank. Under unfavorable circumstances, the openings of the ventilation system can lie below the fuel level in this opening as well, so that ventilation cannot be ensured under all circumstances. In addition, the ventilation system with a plurality of openings requires a significantly higher outlay in terms of manufacture and assembly.

It is also known from US 4,261,477 to arrange chambers before the openings of the ventilation system. These chambers should collect any permeating fuel and immediately return it to the fuel tank via openings.

The object of the present invention is therefore to produce a fuel tank which can be reliably ventilated under all circumstances, the intention being for ventilation to be realizable with as little outlay as possible.

BRIEF DESCRIPTION OF THE INVENTION

According to the invention, the object is achieved by means of a fuel tank as described in the introduction, which has at least one chamber which is designed in such a way that it is designed to hold a volume of liquid above the liquid level of the fuel tank when the fuel tank is in an inclined position, in order to separate said volume of liquid from the remaining volume of fuel for the duration of the inclination.

On account of the fuel stored in the chamber, less fuel is left over in the remainder of the fuel tank. As a result of this, the liquid level is lowered in the fuel tank in an inclined position, so that the ventilation opening which, without the chamber, was previously situated below the liquid level, is now situated above the liquid level. As a result, ventilation of the fuel tank is reliably ensured even in an inclined position. The fuel tank according to the invention permits a simplification of the ventilation system, so that ventilation lines which are complex to manufacture and difficult to assemble can be dispensed with. With appropriate configuration of the chamber, the ventilation system can, in some cases, have only one centrally arranged opening, as a result of which the outlay required for ventilation is considerably reduced.

In an advantageous refinement, the chambers are scoop-shaped, the openings of the chambers pointing toward the side walls of the fuel tank. The base of the chambers is designed in such a way that, in the normal position of the fuel tank, it is horizontal or inclined slightly downward toward the opening of the chambers. As a result, in the normal position, the fuel can flow out of the chambers at all times and is thus available for supply to the internal combustion engine. In an inclined position of the fuel tank, the fuel is retained in the corresponding chamber. In order to ensure ventilation under all circumstances, at least one chamber is arranged on each side of the fuel tank. This ensures that fuel is retained in a chamber, irrespective of which side the fuel tank is inclined toward.

In further refinements, the chambers simultaneously serve as damping elements for the liquid in the fuel tank. For this purpose, various guide elements can be arranged at the outer side of the chambers, which guide elements serve for calming the liquid. The damping elements are advantageously integrally formed on the chambers. Such elements can be retrofitted if they can be connected to the corresponding chamber by means of a plug connection.

In a further refinement, the chambers can serve as mountings for further components to be arranged in the interior of the fuel tank. Lines, filters, suction jet pumps or other functional units can be fastened in the fuel tank by means of locking and plug connections arranged on the outer side of the chambers.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be explained in more detail using a plurality of exemplary embodiments, in which:

Fig. 1: shows a fuel tank according to the prior art;

Fig. 2: shows the fuel tank according to fig. 1 in an inclined position;

Fig. 3: shows a fuel tank according to the invention, and

Fig. 4: shows the fuel tank according to fig. 3 in an inclined position.

DETAILED DESCRIPTION OF THE INVENTION

The fuel tank 1 illustrated in fig. 1 is arranged horizontally and is therefore located in the normal position. The fuel tank 1 is illustrated without fixtures such as fuel supply unit, filter, pressure regulator or lines. The fuel tank 1 is nearly full of fuel 2, so that the liquid level A is located in the upper region of the fuel tank 1. A volume of fuel vapor/air mixture 3 is located above the liquid level A. A ventilation opening 4 belonging to a ventilation system (which is not illustrated in more detail) is arranged centrally in the upper region of the fuel tank 1.

The fuel tank 1 from fig. 1 is arranged so as to be inclined to the left in fig. 2. The inclination of the fuel tank 1 results in the ventilation opening 4 now being located below the liquid level A. The fuel vapor/air mixture 3 is enclosed in the upper right corner of the fuel tank 1 by the fuel 2. In this arrangement, the fuel tank 1 can no longer be ventilated.

Fig. 3 shows the fuel tank 1 according to the invention in the normal position. The fuel tank 1 additionally has two chambers 5, 6 which are arranged on the upper delimiting wall 8 of the fuel tank 1. Both chambers 5, 6 are open toward the side walls 9, 10 of the fuel tank 1. The bases 7 of the chambers 5, 6 are designed to be inclined slightly downward so that, in this position of the fuel tank 1, fuel 2 can flow out of the chambers 5, 6 into the fuel tank 1. Guide elements 11 are fastened to the chambers 5, 6 by means of locking and plug connections 12 for damping the movement of the fuel.

Fig. 4 shows an inclined arrangement of the fuel tank 1. The chambers 5, 6 are likewise inclined on account of the inclination of the fuel tank. The inclination is in this case so small that the slightly inclined base 7 of the chamber 6 is now inclined upward, so that, in this position, the chamber 6 retains a certain amount of fuel 2. Correspondingly, less fuel is left over in the fuel tank 1, so that the fuel level A' is lower than illustrated in fig. 2. On account of the lower fuel level A', the ventilation opening 4 is no longer closed off by the fuel 2. As a result, and in spite of the inclined arrangement, the fuel tank 1 can be reliably ventilated.